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BlackRock.

Seizing the moment in fixed income markets

About CIU

The Client Insight Unit (CIU) is a team of portfolio solutions specialists that partners with our institutional clients and consultants to help them solve their investment challenges. In addition to creating thought leadership like the annual peer analysis, the team leverages the power and breadth of our analytical platform, Aladdin®, for bespoke client engagements — offering tailored portfolio diagnostics to help clients make better informed decisions.

CIU Peer Risk Studies

The fifth edition of our annual Public Pension Peer Risk Study by BlackRock's dedicated Client Insight Unit covers over 120 public pensions varying in size and funded ratio. In addition to our comprehensive research on public pension trends, we analyze 2022 fiscal year allocations, expected risk & return and hypothetical performance across a spectrum of economic scenarios.

Curious how your plan compares to peers? Schedule a consultation to review a customized analysis by contacting us here.

Summary

- **Now that the era of ultralow rates has ended, pensions have a unique opportunity to restructure their approach to achieving return targets**
- **With rates now five times higher than their average over the previous 15 years,[1] fixed income can potentially take some of the pressure off growth-sensitive assets**
- **Opportunities abound in both public and private fixed-income markets, but the inverted yield curve and uncertain macro environment create challenges**
- **A combination of public and private fixed income assets may help pensions improve returns and diversify risk**

For public pension plans, the past two years have been game-changing. A big drawdown in equity markets delivered a blow to investment portfolios, and a sharp rise in interest rates has brought yields to two-decade highs. With equities now well above their 2022 lows and the Federal Reserve (Fed) signaling that it may be nearly done raising rates, the time is right for plans to consider whether a change in their approach to achieving return targets and balancing risks may be warranted.

To help gauge the opportunities and the risks facing plans today, our annual public pensions peer risk analysis assessed the fiscal year 2022 exposures, and their underlying drivers of risk and return, of more than 120 plans whose allocations are modeled using BlackRock's Aladdin risk model. While the implications will vary by plan, one thing stands out: many, if not most, plans have an opportunity to increase their allocations to fixed income and to decrease their exposure to the economic-growth factor.

1 Source: Federal Reserve.

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Lowering return assumptions, increasing alternative allocations

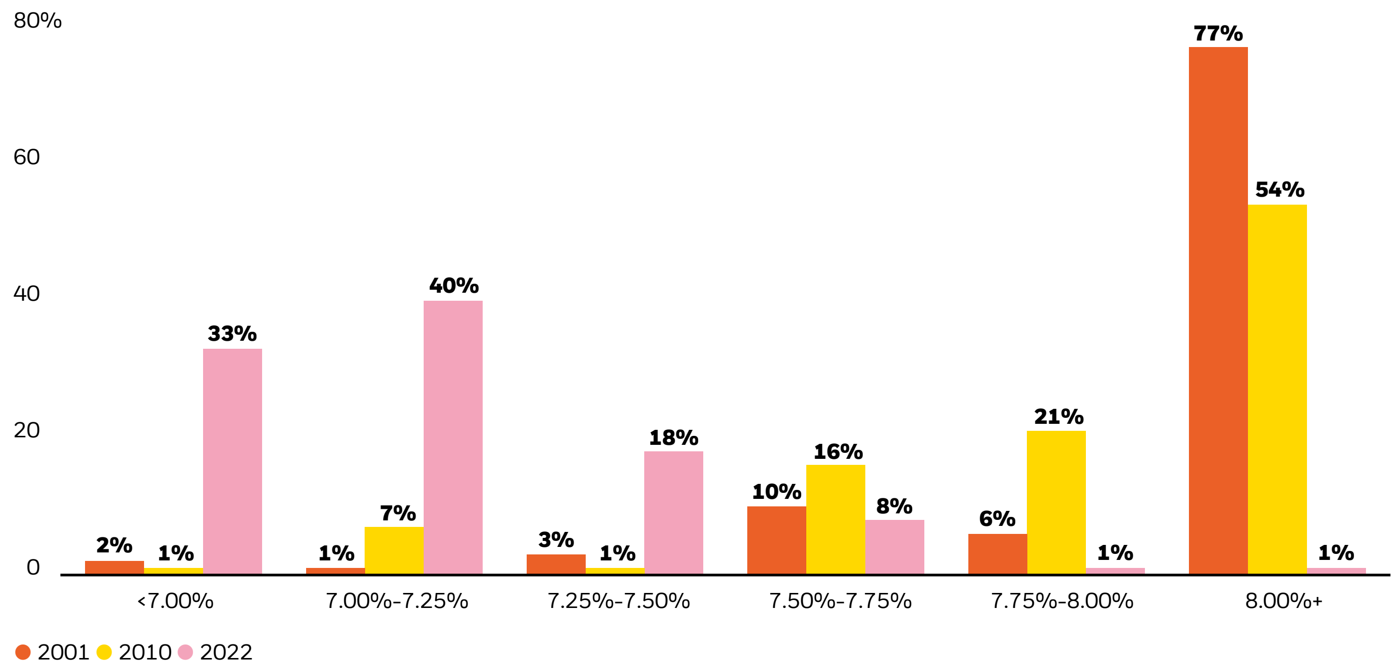
Prior to 2022, public plans spent much of the previous two decades trying to adapt to a world of historically low interest rates. Many responded by lowering their return assumptions. In 2001, the average assumed return was around 8%; today, it is just below 7%. Back then, more than three-quarters of plans had return assumptions greater than 8%; today, just one percent do.[2] See the *Declining assumptions* chart.

In addition to lowering their return assumptions, many plans decreased their allocations to fixed income and increased their allocations to a wide range of alternative assets. In 2022 alone, the average allocation to private markets grew by more than 6%, to 30%, according to data from our 2021 and 2022 research. Some of this increase can likely be attributed to the fact that public equity and fixed income markets experienced steep declines in 2022, while many illiquid private assets did not.

However, the nominal outperformance of some private assets was likely due, at least in part, to the fact they were not marked to market. In addition to increasing the weight of private assets in pension portfolios, this "denominator effect" also resulted in some plans moving beyond their target allocations to alternatives and put pressure on plan liquidity. For more on the denominator effect and its impact, see the sidebar, *Decoding the denominator effect*.

Declining assumptions

Percentage of plans with return targets in stated ranges[2]



2 Source: Public Plans Database and BlackRock, June 2023. Assumed return targets represent 189 plans in FY '01, 214 plans in FY'10, 194 plans in FY'22.

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Decoding the denominator effect

Assessing the effect of market movements on plan allocations, particularly for those assets with less price transparency, is a difficult exercise that requires many assumptions. Leveraging the stress-testing capabilities of our Aladdin® technology, we estimated the impact of the denominator effect by creating two distinct frameworks for evaluating private market drawdowns: (i) the economic lens, which marks to market private assets and (ii) the accounting lens, which shocks private markets at 50% of the drawdown level of the economic lens or a public market-proxy. This approach is meant to model real-world experiences, where private market valuations are not adjusted as quickly or severely as public market assets.

In a simulated market stress where the MSCI World Index is shocked by 1.5 standard deviations and then followed by a 2.5% benefit payment (from cash and public market assets), there was a 4% divide in public and private market exposure between the two frameworks; private market assets fell by 1% when marked-to-market (economic lens) and grew by 3% when the accounting framework was applied. Obviously, but still notable, the accounting lens resulted in more stable NAV progression through the drawdown, as seen in the *Not accounting for everything* chart.

Rethinking portfolio construction

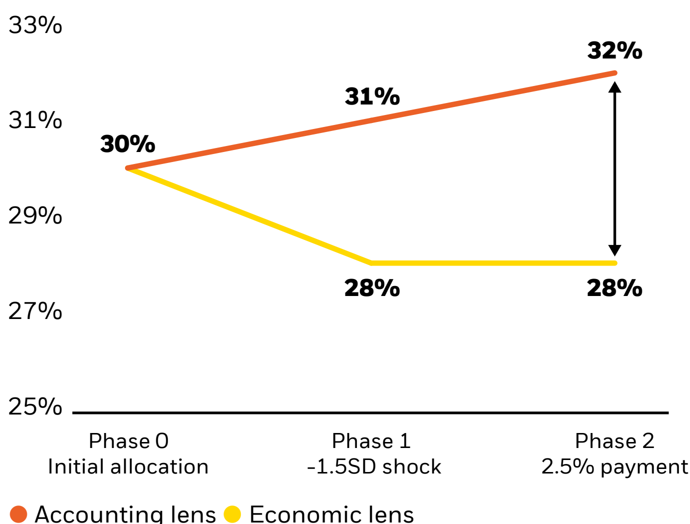
As plans continued to move out of fixed income and into more growth-focused public and private assets, economic growth increasingly became the dominant risk factor in their portfolios, accounting for more than 75% of total risk as of our 2022 fiscal year allocation analysis of over 120 public pension plans.

Today, the average plan has just a 20% allocation to fixed income, and about one in five plans holds less than 15%. This was appropriate in the era of ultralow yields, but that era has ended. Now that shorter-term yields are above 5% — more than five times their average level between 2008-2022 — plans have an opportunity to potentially reduce their absolute risk and diversify their factor exposure.

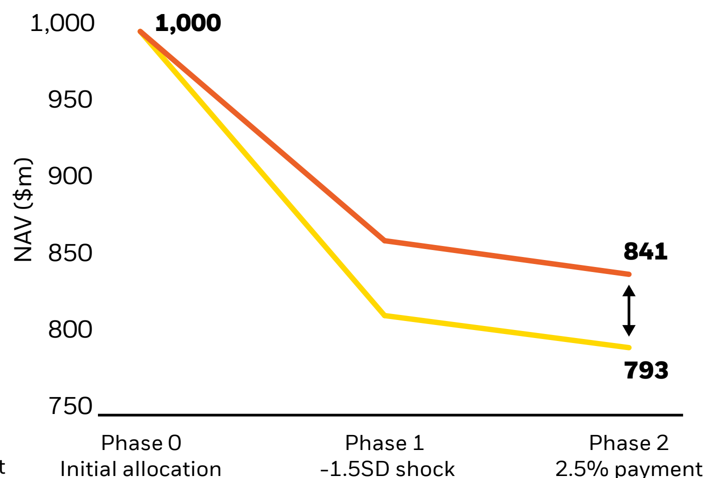
To illustrate the magnitude of the opportunity in fixed income, we created a framework that measures how much plans could allocate to fixed income in different interest rate environments in order to meet a 7% return target. While this framework leverages yield estimations and ignores changes in market prices, its focus on shorter-duration assets limits the price impact of interest rate moves and is analogous to the approach taken in a hold-to-maturity portfolio.

Not accounting for everything

Allocation to illiquid private markets



NAV progression



Accounting lens Economic lens

Hypothetical performance is not a guarantee of future results. Index performance does not reflect the deduction of fees and expenses. Indexes are unmanaged therefore direct investment is not possible. The MSCI World Index captures large and mid-cap representation across 23 Developed Markets countries. The initial allocation includes approximately 100 plans included in BlackRock's FY'22 peer risk analysis and represents the average public pension allocation. **The asset allocation and underlying indices to represent each asset class are included in the important disclosures.** Only private market asset shocks are shown above to reflect the differences between the Economic Lens and Accounting Lens framework. The 2.5% redemption was satisfied by liquidating cash and reducing the remaining amount from public fixed income and equity (pro-rata).

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For simplicity's sake, we used the one-year treasury yield as our fixed income proxy. We start by assuming a 25% allocation to fixed income to solve for the required return of other assets at different stated yields.

Between 2008-2022, the one-year treasury yield averaged just 0.87%, which meant that the remaining 75% of the portfolio needed to return more than 9% to hit the 7% return target, as seen in the left side of the *Taking the pressure off of growth* chart. Fast forward, with one-year treasuries yielding 4.85% as of June 30 (and higher today), and the rest of the portfolio needs to return less than 7.75% to meet the same return target.

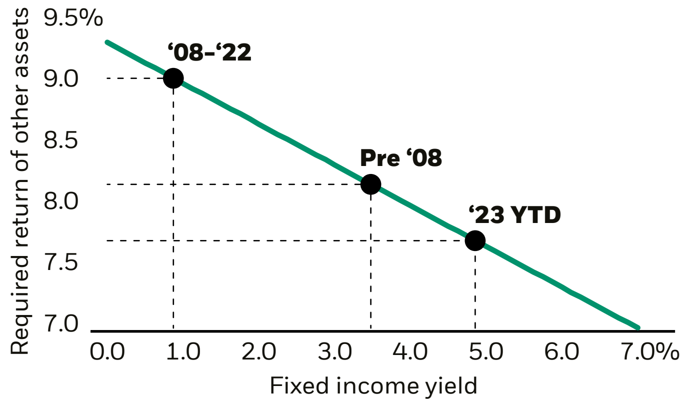
With yields having quintupled, there is clearly room for plans to increase their fixed income allocation. But by how much? That depends on a number of factors, but perhaps chief among them is how much plans expect the rest of their portfolio to return.

On the right side of the *Taking the pressure off of growth* chart, we look at three different return assumptions (8%, 8.5% and 9%) for the non-fixed-income portion of the portfolio and find that plans could allocate between 32% and 48% to fixed income and still meet a 7% return target.

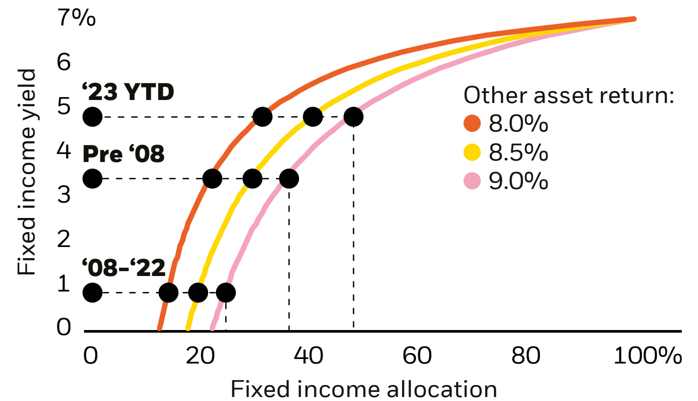
Of course, a 48% allocation to fixed income would be a radical departure from the status quo for most plans, as the average allocation is currently just 20%. And to be clear, we are not advocating doubling the fixed income allocation, but the findings of this analysis should provide an impetus for pensions to reconsider the size and purpose of their fixed income allocations, across both public and private markets.

Taking the pressure off of growth

Required return to meet 7% return target
Assuming 25% allocation to FI returns stated yield



Fixed income allocation to meet 7% return target
Assuming stated yield and other asset return



Source: U.S. Department of Treasury, BlackRock, June 2023. **Past performance is not a guarantee of future results.** Asset allocation does not ensure profit or prevent loss. Returns do not reflect fees and expenses. Pre-'08 includes yields from 2001-2007. '23 YTD yields are through June 30, 2023. Required return of other assets is calculated by solving for the return needed to hit a 7% return target given a 25% allocation to fixed income at the stated yield. The allocation to fixed income is calculated by solving for the allocation needed to hit a 7% return target given the stated yield and other asset return.

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Navigating the curve

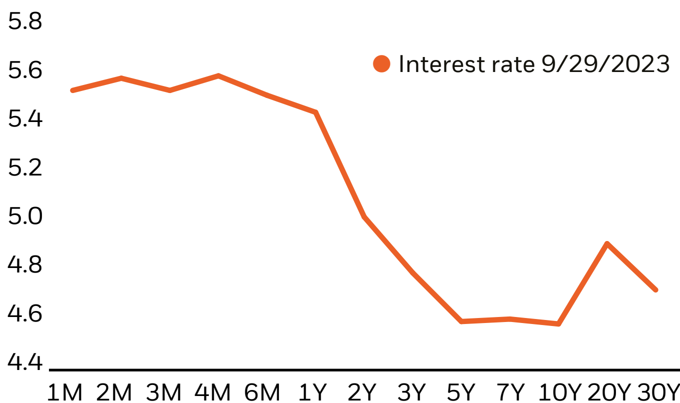
If plans decide that they do want to increase their fixed income allocations, there is no shortage of assets that can deliver both yield and diversification in today's market. But there are important tradeoffs to consider within the fixed income universe.

Given that the yield curve is sharply inverted, with one-month treasuries yielding about one percent more than 10-years as of September 30, according to data from the Fed, many plans are wrestling with the question of where on the curve to invest. See the *Curve conundrum* chart.

Since plans typically have liabilities with long durations, they may be hesitant to allocate to the front end of the curve — despite the significant yield pick-up — because they are concerned about the duration mismatch and the reinvestment risk.

Curve conundrum

Treasury yield curve, September 2023



Source: U.S. Department of the Treasury.

These concerns should not be discounted, but we think that shorter-term assets offer several advantages, in addition to higher yield. Investing in shorter-maturity assets can potentially give plans more flexibility to opportunistically alter their asset allocation when market or macro conditions change. While we believe yields will be higher for longer as the Fed remains firm in its fight against inflation, the inverse relationship between yield and price may provide another source of return for pensions should yields suddenly fall.

Furthermore, if lower yields materialize on the back of softer economic growth, a public pension that has decreased its exposure to the economic-growth factor by upping its allocation to fixed income could be less exposed to public-equity drawdowns. A drawdown may also provide a more attractive entry point for plans to allocate, or reallocate, to growth-sensitive assets like equities at depressed valuations, should the environment for yields and the equity market premium change materially in the future.

We partnered with Illuminas[3] to survey institutions on their shifting objectives, fixed income and where they are seeing the greatest opportunity. We found that four in five respondents are making — or planning to make — changes to fixed income positions.

Explore the survey results

Public or private

Another important consideration for plans looking to add to their fixed income portfolios is whether to pursue opportunities in public or private markets, or in a mix of the two. With treasury and public-market corporate yields hovering near two-decade highs, public assets can certainly do a good deal of the heavy lifting with regard to generating income and providing a return stream that is diversifying to growth-sensitive assets. But private markets also offer potential advantages that may be worth exploring.

By including carefully selected private debt in the fixed income bucket, plans could amplify the yield of their overall portfolios. Private debt may also provide better downside risk management through rigorous underwriting with robust covenant protections that are not necessarily available in public offerings; in the event of a default, this can lead to higher recovery rates and a significant enhancement to risk-adjusted yield.

But private debt comes with its own set of tradeoffs as well. It is, of course, less liquid than most public equivalents, so plans should weigh their overall liquidity requirements carefully. And, depending on the specific assets, private debt may also introduce new idiosyncratic risks into the portfolio.

While the right mix of public and private will differ depending on the specific needs, and the current asset allocation, of each plan, we think that modeling different combinations of the two and seeing how they affect potential return and risk is a worthy starting point.

3 Illuminas is a full-service research consultancy that delivers strategic market intelligence across B2B and consumer markets worldwide.

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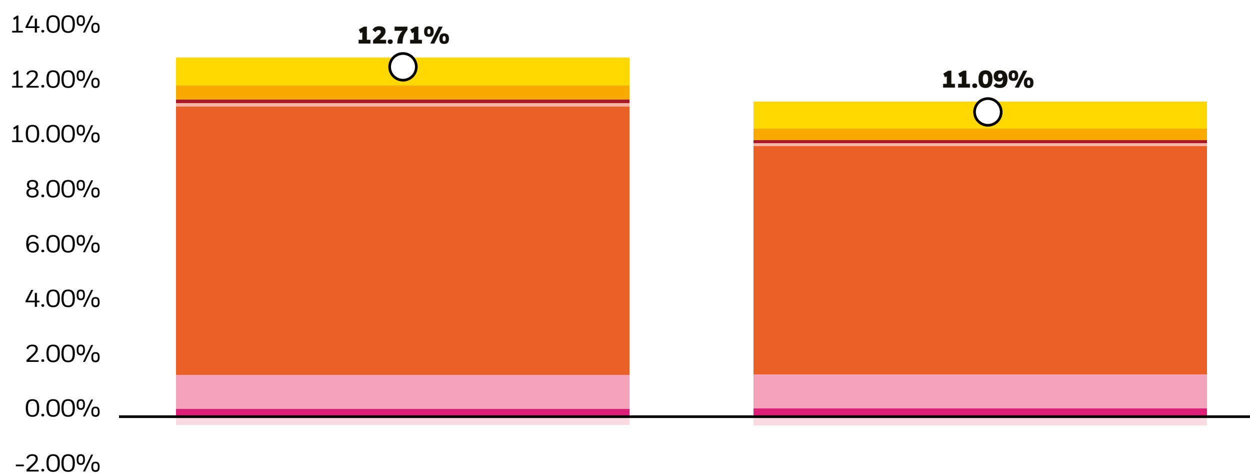
Recalibrating risk

Moving out of equities and other growth-oriented assets and into fixed income will naturally shift the risk exposure of the overall portfolio away from the economic-growth factor and toward the real-rates factor. Given that economic growth accounts for more than three-quarters of the average plan's risk exposure, this may be a desirable outcome for many plans.

To gauge the magnitude of the change in risk composition that a shift into fixed income could provide, we modeled moving 10% of the average plan's equity exposure out of the MSCI All Country World Index (ACWI) and into one-year treasuries. As seen in the *Improving the mix* graphic, this change to the asset allocation decreases absolute risk by 162 basis points and diversifies the portfolio's factor exposure by lowering the concentration of the economic growth factor exposure by 148 basis points.

Of course, a move into one-year treasuries won't be right for every plan, but we think that many plans stand to benefit from moving some portion of their portfolio away from growth-sensitive assets and into fixed income. While the potential future paths of interest rates and economic growth are highly variable, pensions have a clear opportunity to act in the present to take advantage of the current interest-rate environment.

Improving the mix



	Current	Reallocation
Systematic	1.03%	0.98%
FX	0.50%	0.41%
Commodity	0.12%	0.12%
EM	0.12%	0.10%
Economic growth	9.80%	8.32%
Credit	1.24%	1.24%
Real rates	0.24%	0.27%
Inflation	-0.34%	-0.35%
Total	**12.71%**	**11.09%**

Source: BlackRock, June 2023. **Hypothetical results shown are for illustrative purposes only and are not a guarantee of future results.** Risk: Monthly Constant Weighted (MTC model) with 270 monthly observations; 1 standard deviation; 1yr horizon. Ex-ante/Expected risk is defined as annual expected volatility and is calculated using data derived from existing portfolio holdings, using the Aladdin portfolio risk model. The current portfolio includes approximately 100 plans included in BlackRock's FY'22 peer risk analysis and represents the average public pension allocation. The asset allocation and underlying indices to represent each asset class are included in the important disclosures. Indexes are unmanaged therefore direct investment is not possible. Asset allocation does not guarantee profit or prevent loss. There is no guarantee that the results shown will be achieved, and actual risk may be significantly higher or lower than shown. The hypothetical risks are based on criteria applied retroactively with the benefit of hindsight and may affect the results shown. In interpreting hypothetical results, one should take into consideration any inherent limitations and risks of the models used.

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Authors

Jonathan Cogan, CFA, CAIA
Director, Client Insight Unit

Jonathan Cogan, CFA, CAIA, Director, is a member of the Client Insight Unit within BlackRock's Americas Institutional Business, where he focuses on delivering customized portfolio consulting services to institutional clients. Prior to assuming his current responsibilities, Jonathan was a member of BlackRock's Financial Institutions Group where he was responsible for providing advisory services to insurance and other taxable clients. Jonathan began his career in BlackRock's finance department.

Jonathan earned a BA degree from Binghamton University where he double majored in Economics & Philosophy, Politics, and Law, and graduated Phi Beta Kappa and summa cum laude.

Jonathan is the co-founder and treasurer of The Ellie Ruby Foundation, a charity organization dedicated to raising awareness and securing research funding for pediatric cancer.

Sarah Siwinski, CFA
Vice President, Client Insight Unit

Sarah Siwinski, Vice President, is a member of the Client Insight Unit within BlackRock's Americas Institutional Business, where she focuses on delivering customized portfolio consulting services to institutional clients. Prior to joining CIU, Sarah was a member of the Institutional Client Analytics team within BlackRock's Portfolio Analytics Group (PAG). She was responsible for creating and delivering BlackRock's analytical capabilities to the firm and client businesses, specifically through work with the Client Portfolio Solutions team and the Americas Institutional Business.

Sarah joined BlackRock as part of the Graduate Program. She graduated magna cum laude from Fairfield University, with dual B.S. degrees in Finance and Marketing.

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Important disclosures

Asset class	Asset description	Benchmark	10yr. ann expected return	Expected risk
Cash	Cash	U.S. cash	3.38%	0.00%
Fixed income	U.S.	BBG Barc U.S. Aggregate Index	3.47%	5.21%
Fixed income	HY	BBG Barc U.S. Corporate High Yield 2% Issuer Capped Index	5.59%	8.05%
Fixed income	EM	50% JPMGBIEGDV | 50% EMBIGLOBAL Index	5.53%	8.49%
Fixed income	Treasuries	BBG Barc Government Index	3.10%	5.03%
Fixed income	Long duration	BBG Barc Treasury 10+ Yr. Index	2.55%	13.56%
Fixed income	TIPS	BBG Barc U.S. Government Inflation-Linked Bond Index	4.41%	5.53%
Fixed income	Global	BBG Barc Global Aggregate Index	3.92%	5.95%
Fixed income	Bank loans	S&P/LSTA Leveraged Loan Index	6.14%	7.98%
Fixed income	Convertibles	BBG Barc U.S. Aggregate Index	3.47%	5.21%
Fixed income	Multi-strat	BBG Barc U.S. Universal Index	3.80%	4.96%
Fixed income	Securitized	BBG Barc Securitized Index	3.79%	6.00%
Equity	U.S. large cap	Russell 1000 Index	7.34%	17.76%
Equity	U.S. mid cap	Russell Midcap Index	6.58%	18.95%
Equity	U.S. small/mid cap	Russell 2500 Index	6.11%	20.75%
Equity	U.S. small cap	Russell 2000 Index	5.63%	21.59%
Equity	U.S. all cap	Russell 3000 Index	7.19%	17.93%
Equity	Non-U.S./Developed (World ex-U.S.)	MSCI World ex-U.S. Index	8.90%	16.86%
Equity	Non-U.S. (ACWI ex-U.S.)	MSCI All Country World ex-U.S. Index	9.66%	17.59%
Equity	EM	MSCI Emerging Markets Index	9.56%	21.95%
Equity	Global (ACWI)	MSCI All Country World Index	8.01%	17.08%
Alternatives	Hedge funds	BlackRock Proxy: HFRI global fund weighted index (Hedged)	9.11%	6.37%
Alternatives	Private equity	BlackRock Proxy: U.S. Buyout Private Equity – eFront Insights Research U.S. Buyout Private Equity Index	11.26%	32.34%
Alternatives	Commodities	Bloomberg Commodities Index (Unhedged)	3.90%	15.35%
Alternatives	Energy	BlackRock Proxy: Global Diversified Infrastructure – eFront Insights Research Global Infrastructure Index	14.30%	18.99%
Alternatives	Infrastructure	BlackRock Proxy: Global Diversified Infrastructure – eFront Insights Research Global Infrastructure Index	14.30%	18.99%
Alternatives	Timber	Bloomberg Commodities Index (Unhedged)	3.90%	15.35%
Alternatives	Farmland	FTSE Nareit Equity Diversified	3.53%	21.62%
Alternatives	MLPs	Bloomberg Commodities Index (Unhedged)	3.90%	15.35%
Alternatives	Real assets: Other	Bloomberg Commodities Index (Unhedged)	3.90%	15.35%
Alternatives	Real estate: Core	BlackRock Proxy: U.S. Core Real Estate - NCREIF ODCE Index	2.16%	12.27%
Alternatives	Real estate: Core plus	BlackRock Proxy: U.S. Core Real Estate - NCREIF ODCE Index	2.16%	12.27%
Alternatives	Real estate: Value-added	BlackRock Proxy: U.S. Value-Added Real Estate	5.07%	18.75%
Alternatives	Real estate: Opp	BlackRock Proxy: U.S. Value-Added Real Estate	5.07%	18.75%
Alternatives	Real estate: Distressed	BlackRock Proxy: U.S. Value-Added Real Estate	5.07%	18.75%
Alternatives	Real estate: Debt	BlackRock Proxy: Real Estate Mezzanine Debt (Unhedged)	7.31%	10.35%
Alternatives	Real estate: REITs	FTSE EPRA Nareit United States Index	4.85%	20.78%
Alternatives	Real estate: Other	BlackRock Proxy: U.S. Core Real Estate – NCREIF ODCE Index	2.16%	12.27%
Alternatives	Private credit: Distressed	BlackRock Proxy: Direct Lending – Lincoln Senior Debt Index	9.45%	12.00%
Alternatives	Private credit: Mezz	BlackRock Proxy: Direct Lending – Lincoln Senior Debt Index	9.45%	12.00%
Alternatives	Private credit: Direct lending	BlackRock Proxy: Direct Lending – Lincoln Senior Debt Index	9.45%	12.00%
Alternatives	Private credit: Opp	BlackRock Proxy: Direct Lending – Lincoln Senior Debt Index	9.45%	12.00%
Alternatives	Private credit: Special sits	BlackRock Proxy: Direct Lending – Lincoln Senior Debt Index	9.45%	12.00%
Alternatives	Private credit: Other	BlackRock Proxy: Direct Lending – Lincoln Senior Debt Index	9.45%	12.00%
Alternatives	Portable alpha	BlackRock Proxy: HFRI global fund weighted index (Hedged)	9.11%	6.37%
Alternatives	Risk parity	14.75% Long Dur, U.S. HY, TIPS, EMD | 20% MSCI ACWI | 21% Cmdty	5.60%	6.37%

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The representative indices listed above may differ from those that are publicly available, but the underlying methodology and assumptions are consistent. BlackRock expected market return information is based on BlackRock's capital market assumptions as of May 2023 which are subject to change. Capital market assumptions contain forward-looking information that is not purely historical in nature. They should not be construed as guarantees of future returns. The projections in the chart above are based on BlackRock's proprietary capital markets assumptions for risk and geometric return (above) and correlations between major asset classes. These asset class assumptions are passive only and do not consider the impact of active management. The assumptions are presented for illustrative purposes only and should not be used, or relied upon, to make investment decisions. The assumptions are not meant to be a representation of, nor should they be interpreted as BlackRock's investment recommendations. Allocations, assumptions, and expected returns are not meant to represent BlackRock performance.

Capital markets assumptions are subject to high levels of uncertainty regarding future economic and market factors that may affect actual future performance. Ultimately, the value of these assumptions is not in their accuracy as estimates of future returns, but in their ability to capture relevant relationships and changes in those relationships as a function of economic and market influences. Please note all information shown is based on assumptions, therefore, exclusive reliance on these assumptions is incomplete and not advised. The individual asset class assumptions are not a promise of future performance. Indexes are unmanaged and used for illustrative purposes only and are not intended to be indicative of any fund's performance. It is not possible to invest directly in an index.

The Risk Parity asset above was constructed by blending seven capital market assumptions together; please see prior page for more information on each component.

Expected returns shown net of fees and expenses and are for informational purposes only. Expected returns for the following asset classes are inclusive of an additional alpha assumption: Direct Lending: 2.20%, PE: 5.70%, Global Infra Equity: 5.50%, Global Hedge Funds: 3.30%, US Core Real Estate: 0.80%, RE Value Added: 4.40%, RE Debt: 2.20%. The alpha assumption for private markets is defined as expected outperformance from a top quartile manager vs a median manager. For top-quartile performance in PE buyout, direct lending, and mezzanine debt, net of fees Preqin data is used. PE data consists of 800 managers over a 25-year period to 2012 vintage, direct lending and mezzanine debt data consists of 240 managers over the same period. We use forward five-year performance for each fund launched in each calendar year: we find that at least five years' worth of data is needed to draw meaningful conclusions on performance. Infrastructure equity excess returns are assumed to be similar as PE buyout excess returns. Historical National Council of Real Estate Investment Fiduciaries (NCREIF) index performance, with a 5-year lookback period as of March 2019, was used for US core real estate also defined as expected outperformance from a top quartile vs median manager performance, net of fees.

Asset class mapping

Cash: 1.8%   Fixed income: 20.8%   Public equity: 40.8%   Alternatives: 36.6%

Asset class	Asset description	Benchmark/Proxy description	Allocation
Cash	Cash	U.S. cash	2.2%
Fixed income	Domestic	BBG Barc U.S. Aggregate Index	11.9%
Fixed income	Long duration	BBG Barc Treasury 10+ Yr Index	0.5%
Fixed income	Treasuries	BBG Barc Government Index	1.4%
Fixed income	TIPs	BBG Barc U.S. Government Inflation-Linked Bond Index	1.7%
Fixed income	Securitized	BBG Barc Securitized Index	0.7%
Fixed income	Emerging markets	50% JPM GBI-EM Global Diversified Index | 50% JPM Global EMBI Index	0.9%
Fixed income	International/Global	BBG Barc Global Aggregate Index	0.7%
Fixed income	High yield	BBG Barc U.S. Corporate High Yield 2% Issuer Capped Index	1.9%
Fixed income	Bank loans	BlackRock Proxy, based on S&P/LSTA Leveraged Loan Index	0.5%
Fixed income	Multi-strategy	BBG Barc U.S. Universal Index	0.6%
Equity	U.S. all-cap	Russell 3000 Index	9.8%
Equity	U.S. large-cap	Russell 1000 Index	8.8%
Equity	U.S. mid-cap	Russell Midcap Index	0.4%
Equity	U.S. SMID-cap	Russell 2500 Index	0.4%
Equity	U.S. small-cap	Russell 2000 Index	1.5%
Equity	Developed ex-U.S.	MSCI World ex-U.S.	7.0%
Equity	International	MSCI All Country World ex-U.S.	4.9%
Equity	Emerging markets	MSCI Emerging Markets Index	2.9%
Equity	Global equity	MSCI All Country World Index	5.0%
Alternatives	HF	BlackRock Proxy: HFRI Global Fund Weighted Index (Hedged)	4.5%
Alternatives	Risk parity	14.75% Long Dur | 14.75% US HY | 14.75% TIPS | 14.75% EMD | 20% MSCI ACWI | 21% Cmdty	0.8%
Alternatives	Private equity	BlackRock Proxy: U.S. Buyout Private Equity – eFront Insights Research U.S. Buyout Private Equity Index	12.4%
Alternatives	Real estate: REITs	FTSE EPRA Nareit United States Index	0.8%
Alternatives	Real estate: Debt	BlackRock Proxy: Real Estate Mezzanine Debt (Unhedged)	0.3%
Alternatives	Real estate: Core/ Core-plus/Other	BlackRock Proxy: U.S. Core Real Estate - NCREIF ODCE Index	8.0%
Alternatives	Real estate: Value-added/ Opp/Distressed	BlackRock Proxy: U.S. Value-Added Real Estate	1.3%
Alternatives	Real assets: Commodities/Other	Bloomberg Commodities Index (Unhedged)	1.7%
Alternatives	Real assets: Infra/Energy	BlackRock Proxy: Global Diversified Infrastructure – eFront Insights Research Global Infrastructure Index	2.4%
Alternatives	Real assets: Farmland	FTSE Nareit Equity Diversified	0.2%
Alternatives	Private credit	BlackRock Proxy: Direct Lending – Lincoln Senior Debt Index	4.0%

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MKTGM0224U/S-3413653-10/11

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BlackRock Inc.
50 Hudson Yards
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Capital Market and Modeling Assumptions
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References to future returns are not promises or even estimates of actual returns a client portfolio may achieve. Assumptions, opinions and estimates are provided for illustrative purposes only. They should not be relied upon as recommendations to buy or sell securities. Forecasts of financial market trends that are based on current market conditions constitute our judgment and are subject to change without notice. We believe the information provided here is reliable, but do not warrant its accuracy or completeness. If the reader chooses to rely on the information, it is at its own risk. This material has been prepared for information purposes only and is not intended to provide, and should not be relied on for, accounting, legal, or tax advice.

The outputs of the assumptions are provided for illustration purposes only and are subject to significant limitations. "Expected" return estimates are subject to uncertainty and error. Expected returns for each asset class can be conditional on economic scenarios; in the event a particular scenario comes to pass, actual returns could be significantly higher or lower than forecasted. Because of the inherent limitations of all models, potential investors should not rely exclusively on the model when making an investment decision. The model cannot account for the impact that economic, market, and other factors may have on the implementation and ongoing management of an actual investment portfolio. Unlike actual portfolio outcomes, the model outcomes do not reflect actual trading, liquidity constraints, fees, expenses, taxes and other factors that could impact future returns. Asset allocation/diversification does not guarantee investment returns and does not eliminate the risk of loss.

Annualized return assumptions are in geometric terms and reflect total nominal returns. Return assumptions for all asset classes are shown in unhedged terms unless otherwise noted. We use long-term volatility assumptions. We break down each asset class into factor exposures and analyze those factors' historical volatilities and correlations over the past 15+ years. We combine the historical volatilities with the current factor makeup of each asset class to arrive at our forward-looking assumptions. This approach takes into account how asset classes evolve over time. Example: Some fixed income indices are of shorter or longer duration than they were in the past. Our forward-looking assumptions reflect these changes, whereas a volatility calculation based only on historical monthly index returns would fail to capture the shifts. We have created BlackRock proxies to represent asset classes where historical data is either lacking or of poor quality.

Expected return estimates are subject to uncertainty and error. Expected returns for each asset class can be conditional on economic scenarios; in the event a particular scenario comes to pass, actual returns could be significantly higher or lower than forecasted. The geometric return, sometimes called the time-weighted rate of return, takes into account the effects of compounding over the investment period. The arithmetic return can be thought of as a simple average calculated by taking the individual annual returns divided by the number of years in the investment period.

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